Water quality changes in the Broads

Historical perspective

When the broads formed in medieval times in flooded peat pits, they had crystal clear water and were home to a range of specialised water plants. Around the edges of the open water were reeds and other tall vegetation emerging from the shallow water. Up onto drier land there was a gradual transition to open swamp and then fen. This was the pristine or unpolluted condition for these lakes.

This picture taken around the turn of the 19th century shows the profusion of aquatic plants that existed.

During the latter years of the 19th century and the early years of the 20th century, with increasing numbers of people discharging waste into the rivers through the basic sewer system, plant species tolerant of these higher nutrient conditions became dominant. The wetland became richly productive, with abundant plant life giving invertebrates safe cover, and these invertebrates became a rich source of food for fish and waterfowl.

By the mid 1960s submerged water plants, together with much of the reed swamp, had disappeared from all but seven of the 63 broads. In the majority of broads the submerged water plants had been replaced by phytoplankton, or microscopic algae, which had the effect of turning the water green and cloudy. Very little light could penetrate through this algal soup, thus preventing the return of the submerged water plants and their associated wildlife. This is the degraded state that the majority of the broads remain in today.

In a matter of decades there had been a rapid loss in the wildlife diversity of the Broads. The process which has helped cause the loss of water quality is eutrophication. This is the fertilisation of water through nutrient enrichment by phosphates and nitrates. Phosphates mostly enter the waterways via sewage treatment works, while nitrates mainly come from the agricultural land surrounding the Broadland rivers.

Impact on wildlife

Nutrient enrichment causes algae to grow at an increased rate. The algae make the water cloudy so that the submerged water plants, which need sunlight, struggle to survive. The abundance of algae causes a further chain reaction. Without water plants many of the larger aquatic invertebrate and insect species do not occur, which in turn means there is less food for adult fish. The fish population then becomes dominated by small, young fish. These young fish eat Daphnia, or water fleas, which in turn eat algae. Low numbers of water fleas means algal growth remains unchecked and murky green water continues to be the usual condition.

An adult Daphnia, a type of water flea that can eat large amounts of algae

Water plants also act as a shield for river-banks against boat wash and damage caused by mooring. Over the years, the loss of plants, combined with an increase in the number of motor cruisers, exacerbated the problem of bank erosion (link to bank protection). The demise of water plants also meant a loss of anchorage of the river bed sediment leading to a rapid rise in sedimentation rates

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The decline in water quality not only brought devastating consequences for the ecology and landscape of the rivers and broads, but also had economic consequences. Large sums of money are spent every year combating the problems of bank erosion and increased sedimentation. The holiday industry relies on a healthy and attractive environment for its own sustainability.

Improving water quality - phosphate stripping

To improve the Broads environment, nutrient levels had to be reduced. Phosphorus was identified as the key element to tackle, since it is easier to control than nitrogen and can be removed before it is discharged into the water.

Phosphate stripping is an essential first step in the restoration process involving adding ferric sulphate to sewage effluent at sewage treatment works. Phosphate stripping can remove over 90 per cent of the phosphorus at most treatment works, and it has been carried out by Anglian Water at key sewage treatment works in the Broads.

Nitrogen in the Broads

Like phosphorus, nitrogen is a plant nutrient that is naturally scarce, but due to human activities is now abundant. Agricultural run-off is the main source of nitrogen to rivers and broads. Levels of nitrate entering the Broads system have increased since the mid-1940s with heavier use of fertilisers, intensive farming methods, more effective drainage, and improved pumping systems.

Environmentally sensitive farming practices are widely adopted around the Broads, as payments to farmers to manage their land in a less intensive way, helps ensure the economic and environmental value of the area is maintained. Grass buffer strips next to watercourses, application of fertilisers and manure at the right time of year and less intensive grazing all help to reduce the amount of nitrogen entering the water of the Broads.

Antifouling paint

Antifouling paint is commonly used on boat hulls to prevent the nuisance build up of algae and other organisms on the hull. Colonisation by algae is the main fouling issue for boat owners in The Broads, but this is a much less vigorous type of fouling than experienced in marine waters. Toxic substances incorporated into the paints are continually released, effectively preventing colonisation on the painted hull and thus keeping it clean.

Antifoulant paint being applied to a boat hull

However recent research has found that a common antifouling paint ingredient used from the 1960s to the late 1980s, called tributyltin (TBT), had significant effects on the Broads aquatic

ecosystem. TBT was banned in 1987 for use on all boats under 25 m in length because of the environmental damage caused.

Increasingly environmentally friendly alternatives have been produced ever since, including antifouling paints that do not rely on release of toxic substances to keep hulls clean. Advice on how to reduce the environmental impact of antifouling paints if you do choose to use them can be found at http://www.broads-authority.gov.uk/broads/live/boating/facilities-and-access/boating-in-sensitive-areas/Greener_and_cleaner.pdf.